

A new species of *Simulium* (*Gomphostilbia*) (Diptera: Simuliidae) from Northeastern Thailand

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Abstract: *Simulium* (*Gomphostilbia*) *kuvangkaditokae* sp. nov. is described based on male, pupal and mature larval specimens collected from northeastern Thailand. This species is assigned to the *varicorne* species-group of the subgenus *Gomphostilbia* based on the adult antenna composed of the scape, pedicel and eight flagellomeres. The pupal gill, which is composed of two V-shapes inflated elements with 12 thread-like filaments, is very distinctive and easily separates this new species from the other known species.

Key words: Black fly, *Gomphostilbia*, Simuliidae, *Simulium*, *varicorne* species-group

INTRODUCTION

A total of 72 species of black flies were found in Thailand. These species were assigned to six subgenera of the genus *Simulium*; *Asiosimulium* Takaoka and Choochote, *Daviesellum* Takaoka and Adler, *Gomphostilbia* Enderlein, *Montisimulium* Rubstov, *Nevermannia* Enderlein, and *Simulium* Latreille (Takaoka and Choochote, 2004a, b, 2005a-j, 2006a-d, 2007; Phasuk et al., 2005; Jitklang and Kuvangkadilok, 2008). *Gomphostilbia* is the second largest with 17 species assigned to this subgenus. Worldwide there are 163 species of the subgenus *Gomphostilbia* assigned into nine species-groups (Adler and Crosskey, 2008). The *varicorne*-species group is a small group of the *Gomphostilbia* represented by only six species (Adler and Crosskey, 2008). In Thailand, there are three species of *varicorne*-group: *Simulium* (*Gomphostilbia*) *burtoni* Takaoka and Davies, *S. (G.) chumpornense* Takaoka and Kuvangka-

dilok, and *S. (G.) novemarticulatum* Takaoka and Davies. We discovered a new species in the subgenus *Gomphostilbia* during observations of the black flies in northeastern Thailand, which is described based on male, pupa and mature larva.

MATERIALS AND METHODS

All larvae were fixed in Carnoy's solution (1 : 3, glacial acetic acid: 95% ethanol). Three adult males were reared from pupae and fixed in Carnoy's solution. Morphological characters were compared with the descriptions of black flies from West Malaysia and Thailand (Takaoka and Davies, 1995; Kuvangkadilok and Takaoka, 2000; Phasuk et al., 2005). Adult male reared from a pupa were dissected, head and genitalia were cleared with 85% lactic acid and placed in glycerine to illustrate and photograph diagnostic morphological characters. Pupae were placed in acetic acid and examined under a stereo microscope and photographed. Hypostoma, postgenal cleft, and mandible of

the mature larva were placed in a drop of 50% acetic acid on a microscope slide and cover slip was applied and each part was photographed. Morphological terminology follows that of Takaoka and Davies (1995).

The holotype of the new species is deposited in the Natural History Museum, Prathumtani Province, Thailand. The paratypes of this new species are deposited in the Department of Biology, Faculty of Science, Mahasarakham University, Maha Sarakham Province, Thailand.

***Simulium (Gomphostilbia)*
kuvangkadilokae sp. nov.**

DESCRIPTION. Female. Unknown.

Male. Body length ($n=3$) 2.0–2.2 mm. **Head.** Slightly wider than thorax. Upper eye consisting of 9 or 10 vertical columns and 12 horizontal rows of large facets. Face brownish black with white pruinose. Clypeus brownish black, white pruinose, covered with dark brown hairs. Antenna (Fig. 1A) composed of scape, pedicel and 8 flagellomeres, dark yellow on scape and pedicel, 1st, 2nd, and 4th flagellomeres whitish brown, 3rd, and 5th to 8th flagellomeres dark brown. Maxillary palp (Fig. 1B) composed of 5 segments, brown, proportional lengths of 3rd, 4th, and 5th segments 1.0 : 1.25 : 3.0, sensory vesicle small, ellipsoidal, 0.38 times as long as 3rd segment. **Thorax.** Scutum black, with white pubescence and densely covered with whitish yellow short hairs. Scutellum brownish black, densely covered with yellow short hairs as well as several dark brown long upright hairs. Postnotum brownish black, white pruinose, bare. Pleural membrane bare. Katepisternum brownish black with fine, short, yellowish hairs. **Legs.** Foreleg: coxa and trochanter whitish yellow, femur and tibia medium brown, tarsus brownish black, basitarsus dilated, 6 times as long as its greatest width. Midleg: coxa medium brown, trochanter whitish yellow, femur light to medium brown, tibia dark brown except less than basal 1/2 light brown, tarsus brownish black except basal 2/3 of basitarsus and basal 1/3 of 2nd and 3rd segments yellow. Hind leg (Fig. 1C): coxa medium brown, trochanter whitish yellow, femur medium brown except apical cap brown-

ish black, tibia yellowish brown on basal 3/5 and brownish black on rest, tarsus dark brown except basal 3/5 of basitarsus and basal 1/3 of 2nd and 3rd segments whitish yellow; basitarsus slender and parallel sided shape. Calcipala 1.3× as long as wide, pedisulcus well developed. All femora, tibiae and parts of tarsi densely covered with scale-like hairs as well as usual simple hairs at least on outer and posterior surfaces. **Wing.** Length 2.0 mm. Costa with spinules and hairs. Subcosta bare. Hair tuft on stem vein yellow. Basal portion of radial vein fully haired. R_1 with spinules and hairs. R_2 with hairs only. Basal cell and basal medium cell absent. **Abdomen.** Basal scale brownish black, with fringe of whitish yellow. Dorsal surface of abdominal segments brownish black, except 2nd segment yellowish brown, covered with dark hairs. Segments 2 and 5–7 with a dorsolateral pair of shiny areas. **Genitalia.** Coxite (Fig. 1D) large, subquadrate, 1.6 times as long as wide when viewed ventrally. Style (Fig. 1D) slightly shorter than coxite, curved inward, tapered toward apex, with single apical spine. Ventral plate (Fig. 1E–G) in ventral view with nearly rectangle in shape, basal arms directly forward and then inward. Median sclerite (Fig. 1H) plate-like, long and almost parallel sided. Parameres (Fig. 1I) broad basally, each with 3 long apical hooks and several short ones. Aedeagal membrane moderately setose.

Pupa. Body length (excluding gill filaments) 2.5 mm. **Head.** Integument yellow densely covered with round tubercles, antennal sheath bare, head with 1 facial and 3 frontal pairs of long simple trichomes. **Thorax.** Integument yellow, densely covered with round tubercles on anterior 2/3, and almost bare on posterior 1/3; thorax with 3 long simple trichomes mediodorsally, 2 long simple trichomes anterolaterally, 1 medium long simple trichome posterolaterally. Gill (Fig. 1J) composed of V-shaped inflated structure in lateral view, with 12 slender thread-like filaments, 8 on the dorsal inflated element and 4 on the ventral inflated element. Surface of the inflated elements with numerous cone-shaped processes and covered with minute tubercles. Of the 12 thread-like filaments 1 arising from the apex of the ventral element, 1 arising near the apex of the dorsal inflated element, of the remaining 10 filaments 7 arising from the outer surface of the dorsal inflated element and 3 arising from the outer

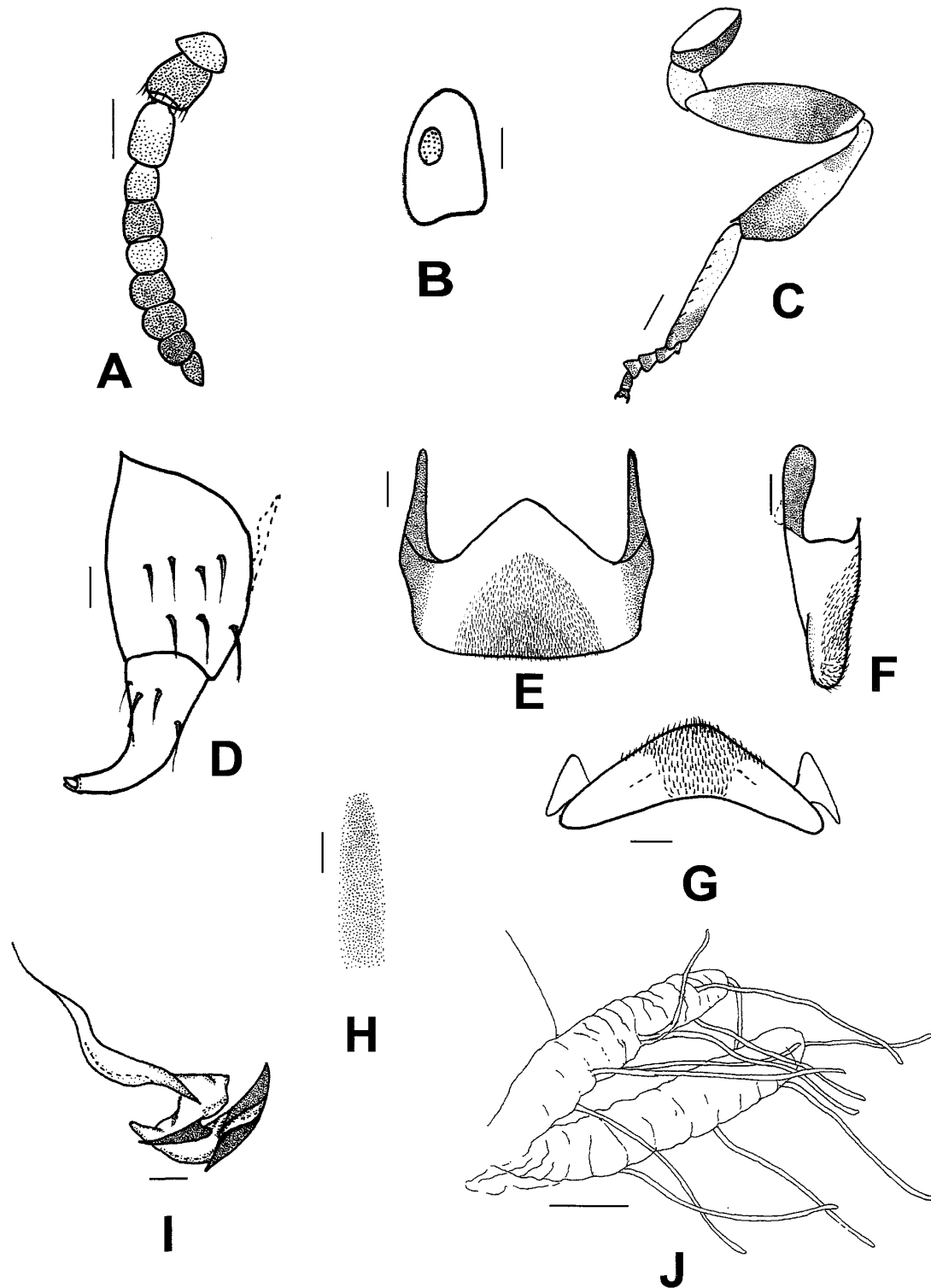


Fig. 1. Adult male of *Simulium* (*Gomphostilbia*) *kuvangkadilokae* sp. nov. A, antenna (left side); B, 3rd segment of maxillary palp (right side, front view); C, hind leg (right side, inner view); D, coxite and style (left side, ventral view); E, F, and G, ventral plate (E, ventral view; F, lateral view; G, end view); H, median sclerite (end view); I, paramere (ventral view); J, gill filaments (right side, dorsal view). Scale bars. 0.06 mm for A; 0.02 for B; 0.1 mm for C; 0.02 mm for D-I; 0.2 mm for J.

surface of the ventral inflated element. All of the thread-like filaments are individually arising from the inflated element, subequal in length and thickness, with distinct annular

ridges and furrows. **Abdomen.** Tergum 1 with single long dark seta on each side, tergum 2 with 1 medium long simple and 5 short setae on each side, terga 3 and 4 each with 4 stout

hooks and 1 short pale spine on each side, tergum 5 bare, terga 6–9 each with spine-combs and comb-like groups of minute spines along anterior margin on each side. Tergum 9 with pair of conical terminal hooks, with round apex. Sternum 4 with 1 simple hook and a few minute setae on each side; sternum 5 with pair of bifid hook on each side; sternum 6 with 1 simple hook on each side; sternum 7 with 1 bifid hook on each side; last segment with 3 grapple-like hooklets on each side. **Cocoon.** Simple, wall-pocket shaped, densely woven, moderately extending ventrolaterally.

Mature larva. Body length 4.5 mm. Thorax grayish brown with grayish transverse band, abdominal segment 1–5 each with reddish brown or grayish transverse band. Cephalic apotome pale yellow, darkened along posterior margin, moderately covered with simple colorless setae; head spot indistinct. Antenna with three segments plus apical sensillum, longer than stem of labral fan; proportional lengths of three segments from proximal to distal 0.7 : 1.0 : 0.5; base of antenna brown and remainder pale yellow. Labral fan with 24–26 primary rays. Mandible (Fig. 2A) with comb-teeth decreasing in length from 1st to 3rd, mandibular serrations consisting of 1 large and 1 small tooth. Hypostoma (Fig. 2B) with a row of 9 apical teeth, median tooth as long as corner tooth; lateral margins serrated throughout their length, hypostomal bristles 3 or 4 in numbers, slightly diverging posteriorly from lateral margin on each side. Postgenal cleft (Fig. 2C) very deep reaching posterior margin of hypostoma. Thoracic segment 1 and 2 with two pairs of minute conical protuberance, segment 3 with 4 pairs of conical protuberance (2 dorsal, 1 dorsolateral, 1 lateral); thoracic cuticle sparsely cover with simple, bifid, trifold and rarely quadrifold setae similar to those on the abdomen. Dorsum of abdominal segment 1–5 each with 4 pair of conical protuberances (2 dorsal, 1 dorsolateral, 1 lateral), size and shape of the protuberance are shown in Figure 2D; abdominal cuticle with simple, bifid, trifold and rarely quadrifold setae (Fig. 2E), which are almost colorless except base darkened, sparsely on segment 1–4 and densely on segment 5–8; last segment moderately cover with simple, bifid and trifold setae on each side of the anal sclerite. Ventral papillae well developed. Rectal papilla composed of 3 lobes each with 6 finger-like secondary lobules. Anal sclerite X-

shaped with posterior arm ca.1.2 times as long as anterior arm. Accessory sclerite absent. Posterior circlet with about 68 rows of 10–12 hooklets per row.

TYPE SPECIMENS. Holotype male with its associated pupal exuvia and cocoon, collected at Tad Yai Waterfall, N 16°04'06"E104°57'01"), Chanuman District, Amnat Charoen Province, Thailand, 22. IX. 2007, by Pairot Pramual. Paratypes: 3 males with pupal exuviae and cocoons (in Carnoy's fixative), 13 pupae and 8 mature larvae (in Carnoy's fixative), same data as for holotype.

ECOLOGICAL NOTES. The larvae and pupae of *S. (G.) kuvangkadilokae* sp. nov. were attached to trailing grass in a warm (28.9°C), open, slow-flowing stream at altitude 132 m. This species was collected with *S. (S.) nakhonense* Takaoka and Suzuki.

ETYMOLOGY. The species name *kuvangkadilokae* is in honor of Associate Prof. Chaliow Kuvangkadilok, Department of Biology, Faculty of Science, Mahidol University, Thailand, who has a pioneer work on cytogenetics of black flies in Thailand.

REMARKS. *Simulium (G.) kuvangkadilokae* sp. nov. is assigned to the *varicorne* species-group on the basis of the adult antenna with 10 segments (Takaoka and Davies, 1995). Color pattern of the antenna also resembles those of the known species of the *varicorne*-species group (Takaoka and Davies, 1995).

This species is characterized by pupal gill which has two inflated elements with 12 thread-like filaments. This is the most distinctive character that easily differentiates this new species from other species. The other species of the *varicorne* species-group including *S. (G.) burtoni*, *S. (G.) chumpornense*, *S. (G.) novemarticulatum*, *S. (G.) shogakii* Rubtsov, and *S. (G.) varicorne* Edwards have eight gill filaments. The

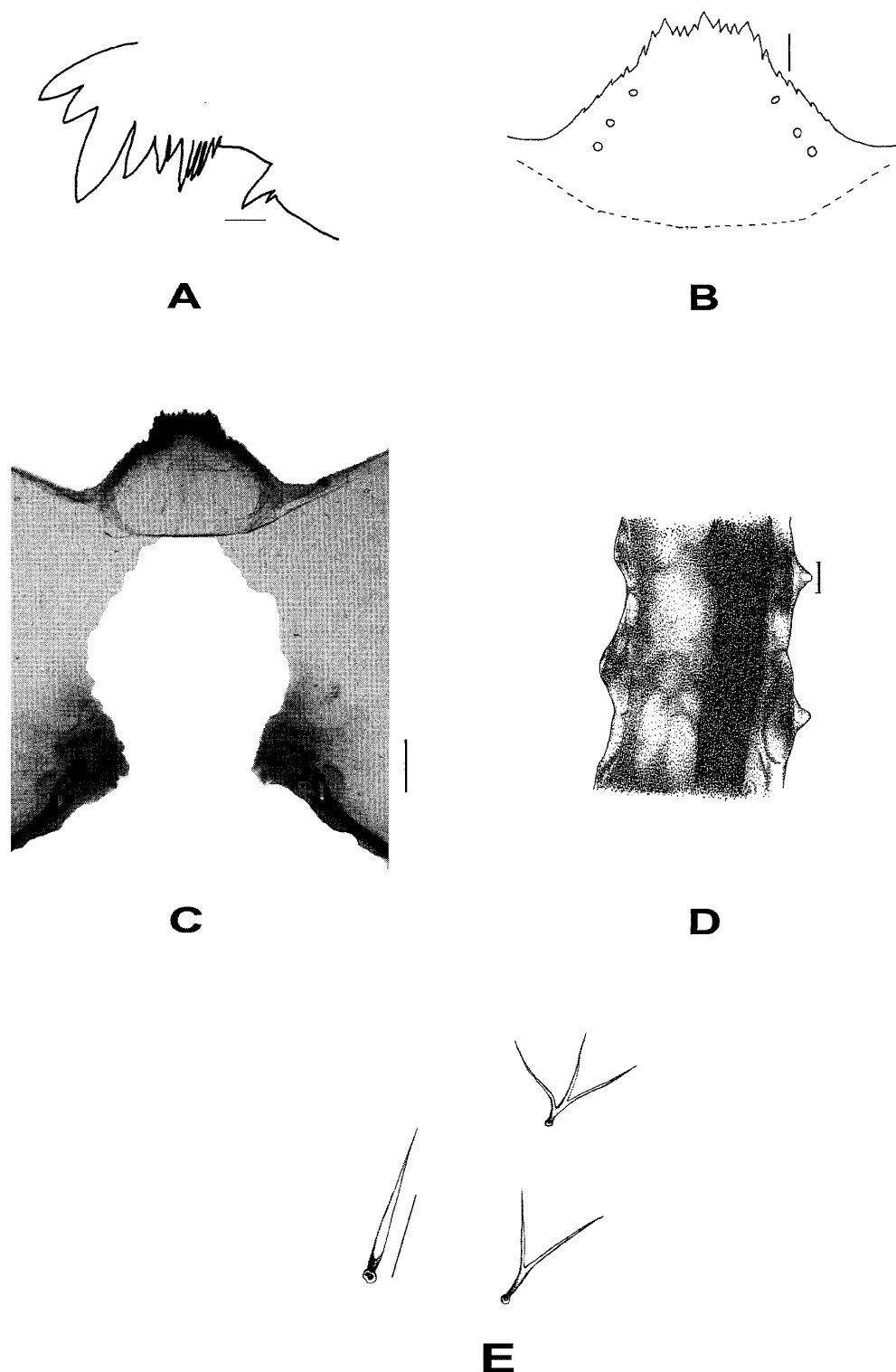


Fig. 2. Larva of *Simulium* (*Gomphostilbia*) *kuvangkadilokae* sp. nov. A, mandible; B, hypostoma (ventral view); C, postgenal cleft (ventral view); D, protuberances on the abdominal cuticle; E, abdominal setae. Scale bars. 0.01 mm for A and D; 0.02 mm for B; 0.05 mm for C; 0.025 for E.

pupal gill of this new species is similar to *S. (G.) prayongi* Takaoka and Choochote described from northwestern Thailand (Takaoka and Choochote, 2005e) by having V-shape inflated elements with

thread-like filaments. However, *S. (G.) kuvangkadilokae* sp. nov. differs from *S. (G.) prayongi* by having 12 thread-like filament instead of 8 as in *S. (G.) prayongi*.

The adult of *S. (G.) kuvangkadilokae* is

distinguished from *S. (G.) novemarticulatum* by number of antennal segments, consisting of 2+8 segments in the former but 2+7 in the latter species. Adult male of this new species differs from *S. (G.) burtoni* by the number of eye facets in vertical column (9 or 10 in the former and 12 or 13 in the latter species). Male genitalia are similar to *S. (G.) varicorne* Edwards. However, it is separated from *S. (G.) varicorne* Edwards by the larger size of sensory vesicle.

The larva of *S. (G.) kuvangkadilokae* is most similar to *S. (G.) chumpornense* by having deep postgenal cleft, with protuberances on the abdominal segments 1–5 and with simple, bifid, trifid and quadrifid setae on the abdominal cuticle. However, *S. (G.) kuvangkadilokae* is distinguished from *S. (G.) chumpornense* by numbers of the protuberance (four pairs of conical protuberance on the abdominal segments 1–5 in the former, two pairs in the latter species (Kuvangkadilok and Takaoka, 2000)).

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REFERENCES

- Adler, P.H. and Crosskey, R.W. 2008. World Blackflies (Diptera: Simuliidae): A Fully Revised Edition of the Taxonomic and Geographical Inventory. <http://entweb.clemson.edu/biomia/pdfs/blackflyinventory.pdf> [accessed 14 May 2008]
- Jitklang, S. and Kuvangkadilok, C. 2008. A new species of *Simulium (Gomphostilbia)* (Diptera: Simuliidae) from southern Thailand, with description of its polytene chromosome. *Stud. Dipt.*, (in press).
- Kuvangkadilok, C. and Takaoka, H. 2000. Taxonomic notes on Simuliidae (Diptera) from Thailand: description of a new species and new distributional records of nine known species. *Jpn. J. Trop. Med. Hyg.*, 28: 167–175.
- Phasuk, J., Chanpaisaeng, J., Adler, P.H. and Courtney, G.W. 2005. Chromosomal and morphological taxonomy of larvae of *Simulium (Gomphostilbia)* (Diptera: Simuliidae) in Thailand. *Zootaxa*, 1052: 49–60.
- Takaoka, H. and Choochote, W. 2004a. A list of and keys to black flies (Diptera: Simuliidae) in Thailand. *Trop. Med. Health*, 32: 189–197.
- Takaoka, H. and Choochote, W. 2004b. Taxonomic notes on the *griseifrons* species-group of *Simulium (Simulium)* (Diptera: Simuliidae) in northern Thailand. *Trop. Med. Health*, 32: 311–327.
- Takaoka, H. and Choochote, W. 2005a. Two new species of *Simulium (Montisimulium)* (Diptera: Simuliidae) from northern Thailand. *Med. Entomol. Zool.*, 56: 21–31.
- Takaoka, H. and Choochote, W. 2005b. A new subgenus and a new species of *Simulium* s.l. (Diptera: Simuliidae) from Thailand. *Med. Entomol. Zool.*, 56: 33–41.
- Takaoka, H. and Choochote, W. 2005c. A new species of *Simulium (Simulium)* (Diptera: Simuliidae) from Thailand. *Med. Entomol. Zool.*, 56: 43–47.
- Takaoka, H. and Choochote, W. 2005d. Two new species of *Simulium (Simulium)* (Diptera: Simuliidae) from northern Thailand. *Med. Entomol. Zool.*, 56: 99–110.
- Takaoka, H. and Choochote, W. 2005e. Two new species of *Simulium* Latreille (Diptera: Simuliidae) from northwestern Thailand. *Med. Entomol. Zool.*, 56: 123–133.
- Takaoka, H. and Choochote, W. 2005f. Two new species of *griseifrons* species-group of *Simulium (Simulium)* (Diptera: Simuliidae) in northern Thailand. *Med. Entomol. Zool.*, 56: 219–235.
- Takaoka, H. and Choochote, W. 2005g. Two new species of black flies (Diptera: Simuliidae) from Thailand. *Med. Entomol. Zool.*, 56: 319–334.
- Takaoka, H. and Choochote, W. 2005h. A new species of *Simulium (Simulium)* from northern Thailand (Diptera: Simuliidae). *Trop. Med. Health*, 33: 95–101.

- Takaoka, H. and Choochote, W. 2005i. Two new species of *Simulium* (*Nevermannia*) (Diptera: Simuliidae) from northern Thailand. *Trop. Med. Health*, 33: 133–141.
- Takaoka, H. and Choochote, W. 2005j. Discovery of two more species of *Simulium* (*Montisimulium*) (Diptera: Simuliidae) in Doi Inthanon National Park, Chiang Mai, Thailand. *Trop. Med. Health*, 33: 209–215.
- Takaoka, H. and Choochote, W. 2006a. A new species of the subgenus *Simulium* (*Asiosimulium*) (Diptera: Simuliidae) from Thailand. *Med. Entomol. Zool.*, 57: 45–48.
- Takaoka, H. and Choochote, W. 2006b. A new species of *Simulium* (*Nevermannia*) from northern Thailand (Diptera: Simuliidae). *Med. Entomol. Zool.*, 57: 83–92.
- Takaoka, H. and Choochote, W. 2006c. A new species of the *griseifrons* species group of *Simulium* (*Simulium*) (Diptera: Simuliidae) in northern Thailand. *Med. Entomol. Zool.*, 57: 115–124.
- Takaoka, H. and Choochote, W. 2006d. A new species of *Simulium* (*Gomphostilbia*) (Diptera: Simuliidae) from northern Thailand. *Med. Entomol. Zool.*, 57: 229–233.
- Takaoka, H. and Choochote, W. 2007. A new species of the *multisimulium* species-group of *Simulium* (*Simulium*) (Diptera: Simuliidae) from Northern Thailand. *Trop. Med. Health*, 35: 19–22.
- Takaoka, H. and Davies, D. M. 1995. The Black Flies (Diptera: Simuliidae) of West Malaysia. 175 pp., Kyushu University Press, Fukuoka.